Butt Valley Dam
Butt Valley Reservoir Road
Caribou Vicinity
Plumas County
California

HAER No. CA-189

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
San Francisco, California

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HISTORIC AMERICAN ENGINEERING RECORD
BUTT VALLEY DAM
HAER No. CA-189

Location: Butt Valley Dam
Butt Valley Reservoir Road
Caribou vicinity
Plumas County, California

U.S.G.S.: Caribou, 7.5' Topographic Quadrangle, 1979
UTM Coordinates: Zone 10 (a) 658430 E, 4441970 N; (b) 658300 E, 4441870 N; (c) 657830 E, 4441950 N; (d) 658085 E, 4442160 N

Date of Construction: 1921; modified in 1924 and 1927

Engineer: Stone and Webster (1921) and C.M. Mardel and James D. Galloway (1924)

Designer: Julius Howells (1924)

Builder: Niels Schultz (1924)

Present Owner: Pacific Gas and Electric Company (PG&E)
77 Beale Street
San Francisco, California 94106

Present Use: Dam

Significance: Butt Valley Dam was constructed during the development of North Fork Feather River hydroelectric power and was part of the overall system. The existing dam consists of the 1921 rock fill dam and the 1924 hydraulic-fill dam, connected by silt blankets laid in 1927. The 1924 dam was designed by Julius Howells, a key player in the development of the Great Western Power Company and of hydroelectricity in California. The dam has remained essentially unaltered since the 1927 connection.

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Date: November 1997

I. DESCRIPTION

The Butt Valley Dam is located near the headwaters of the north fork of the Feather River, and its reservoir is one of the principal water storage facilities for PG&E's hydroelectric projects located on the Feather River (CA-189-3). The water released from Butt Valley Reservoir is used by PG&E for power generation at the Butt Valley Powerhouse, Caribou Powerhouse No. 1 and 2, Oakflat Powerhouse, Beldon Powerhouse, Rock Creek Powerhouse, Cresta Powerhouse and Poe Powerhouse. Butt Valley Reservoir serves as the forebay for the two Caribou powerhouses.

A gate tender's residential complex, which includes a house, barn and shed, is located near the southwest edge of the reservoir (see HAER Nos. CA-189-A, CA-189-B, CA-189-C for information regarding the house, barn, and shed).

II. ENGINEERING INFORMATION

The Butt Valley Dam is a hydraulic fill structure composed of a puddle core, two hydraulic slopes, and rock fill toes on the upstream and downstream sides. The dam has a total crest length of 1,370 feet and a crest thickness of 25 feet. A concrete parapet wall extends along the top of the crest.

The upstream slope is 3.5:1 and the downstream slope has a ratio of 3 and 2:1. Completed in 1924 for a cost of about $388,000, the dam impounds water in a 75-mile-square drainage area and holds about 50,000 acre-feet of water. Leakage in 1927 resulted in the Great Western Power Company (GWP) laying four silt blankets on the upstream side of the dam. One of these extended from the crest of the old rock fill dam to the upstream slope. Associated features of the dam include a concrete spillway, located on the south side of the dam (Maniery and Baker 1996).

III. HISTORICAL INFORMATION

Early Hydroelectric Development in California

Hydroelectric generation began to take hold in California during the 1890s. As high voltage transmission technology evolved, the transportation of electrical power over hundreds of miles became possible and development surged. No restrictions on energy prices had been instituted and, other than steam plants, the only fuel readily available was oil, which fluctuated radically in price. In response to this new hydroelectric technology and increasing interest in water rights, the State of California by 1911 passed laws to control water appropriation for power development. Soon after, the Railroad Commission Act created the public control of power rates, eventually evolving into the Public Utilities Commission (Hockett 1927:i; Means 1949:7-8).

Engineering firms on the East coast began developing operations in California around this time, including Boston-based Stone and Webster, who were active on the Truckee, Feather and American rivers and also worked as engineers for Southern California Edison on the San Joaquin River. Large municipalities soon began competing to acquire water rights on major rivers (Means 1949:7).

GWP, along with five other northern California power companies, rushed to secure rights for hydroelectric development on rivers in northern California. GWP acquired important rights on the north fork of the Feather River and began plans to build power plants and reservoirs using these rights. These plans included building a dam at Butt Valley (Hockett 1927:i; Means 1949:7-8, 12; Shoup and Cornford 1987:12).

Historically Butt Creek flowed through a long, narrow valley - Butt Valley - and plunged a thousand feet to the headwaters of the north fork of Feather River in the canyon below. Today the valley, with a drainage of 75 square miles, is dammed at its outlet, creating a reservoir known as Butt Lake (Galloway 1929:4).

Butt Valley was occupied long before its development for hydroelectric operations. The community, which included a post office, hotel, store, a Chinese section, and eventually a school, was considered one of the liveliest spots in western Plumas County during the 1870s (Richards 1963:1). A number of families also operated dairies in the valley from the mid-1800s. Some remained until their land was purchased by the Western Power Company (WPC) at the turn of the century. Between 1901 and 1902, WPC acquired all of Butt Valley, over 3,000 acres, for its hydroelectric operations there (Wickman 1972:30-31).

Butt Valley had long been viewed a potential hydroelectric generation reservoir. On April 8, 1902, Augustus Bidwell filed a water appropriation notice with Plumas County for water from Butt Creek. This water would be conveyed to the Feather River Canyon near Caribou for a new 300,000 horsepower hydroelectric plant to be constructed there. WPC began clearing and burning timber and underbrush on the site and digging a tunnel and test pits on the center line of the dam to the 100 feet contour on both sides of the creek (Western Power Company 1902:n.p.; Wickman 1972:30).

In 1902, WPC began building one of the first dams on Butt Creek. The company began clearing and burning timber and underbrush on the site and digging a tunnel and test pits on the center line of the proposed Butt Valley Dam to the 100-foot contour on both sides of the creek. However, further construction was stalled until WPC had been reincorporated as the GWP (Western Power Company 1902:n.p.; Wickman 1972:30). This reincorporation took place in 1906 (Coleman 1952:350).

Great Western Power Company Dam -- 1911

As demand for electricity surged during the 1910s, GWP began making plans to expand their power generation capacities. A small rock fill dam, upstream from the present dam, was built in 1911 in preparation for construction of the first Almanor Dam, also known as the Eastwood Dam (Geomatrix 1995:3). GWP built a small power plant at Butt Valley to provide power for hydraulic sluicing used to create Almanor Dam. The drainage area of Butt Valley consists of 83.5 square miles. Ultimately, its principal water supply came from Lake Almanor once the Big Meadows Dam and tunnel was constructed (Jansen and Leps 1984:3).

By 1910, GWP had enough men working in the Butt Valley area to warrant stationing a company physician there. Dr. Fred J. Davis, Sr., and his wife spent a year there caring for the workmen, including the families of roughly 30 married workers. In 1911, the GWP had nearly 100 men working in the valley. They built a sawmill and a hydroelectric plant to power it. The GWP plant contained two 400-KV generating units operated by two Pelton impulse wheels. Its power was used for construction from 1911 to 1915, and then sold to local mines after that (Wickman 1972:38).

Water from Butt Creek was diverted to a 8,460-foot-long flume and then to a pressure pipe into the small power plant. The flume used the same bench carved by the old Cariboo Mining Company for their flume used in hydraulic mining. This flume was over-structured with planks so that vehicles could drive on it (Kramar 1963:10; Siler 1996).

Construction of Stone and Webster Dam -- 1919-1921

Due to the continued demand for electricity, GWP decided to build the Caribou Powerhouse 12 miles downstream from Lake Almanor, powered with water from the lake conveyed through Butt Valley. Water from Lake Almanor was conveyed by tunnel to Butt Creek in Butt Valley. Tunnel 1, the Prattville tunnel, was 11,200 feet long. The water flowed six miles through Butt Creek into the dam-impounded two-mile-long Butt Valley Reservoir. Water was then released from this reservoir into a penstock leading to the powerhouse. By 1915, the GWP owned 1,780 acres of land in Butt Valley for the Butt Valley Reservoir, which would hold an expected capacity of 106,000 acre feet. Construction of the Caribou Powerhouse began in 1919 under the direction of Stone and Webster Company, an engineering firm from Boston, Massachusetts (see attached map depicting Caribou Powerhouse development) (Coleman 1952:274; Lippincott 1915:7; Shoup and Cornford 1987:15, 17).

The first work phase included building construction supply railroads and 12 construction camps. Railroad construction consisted of building nine-and-a-half miles of branch railroad from the Western Pacific line at Listo (later renamed Howells) to the Caribou powerhouse site. An additional 13 miles of narrow-gauge railroad near Butt Creek was built to supply lumber for

concrete forms and buildings. The latter railroad consisted of three lines connected by three incline railways. This phase was completed by January 1920 (Shoup and Cornford 1987:14, 16).

The next phase included tunnel, powerhouse and dam construction, completed by the erection of the transmission line. The Butt Valley Dam was constructed to increase the capacity of a naturally existing reservoir. It was built in part using a hydraulic monitor to sluice rocks and dirt into the neck of Butt Valley and impound Butt Creek. The simple rock fill dam was 26 feet high, 40 feet wide at the top, and 110 feet at the bottom with an elevation at the top of the dam at 4,096 feet above mean sea level (amsl). At one end of the dam was a 9-foot-wide electric sluice gate set in a reinforced-concrete gate house. This gate served as the entrance to Tunnel 2 (Shoup and Cornford 1987:17).

The 1911 GWP dam was located at the same site as the old Caribou Mining Company ditch diversion dam. The construction contractors for the 1921 dam, Stone and Webster, built their rock fill dam farther upstream when they began the Caribou powerhouse development. The Stone and Webster dam consisted of two rock fills made from materials excavated during tunnel construction with finer material sluiced between them to decrease permeability. They built a 7' 4" diameter concrete outlet pipe through the dam with a timber headgate. Its concrete spillway crested at 4,086 feet amsl. Five-foot-tall flashboards set in place raised the reservoir elevation to 4,091 feet amsl. These flashboards were replaced in 1923. Unfortunately there were numerous leaks along the spillway sides and outlet pipe (Mardel 1933:n.p.).

When the GWP decided to improve the Butt Valley Dam again in 1923, more families left the valley. Cottages, barns, the local school and the Butt Valley Hotel were salvaged and burned. Windows and hardware removed from the hotel were used in constructing a new two-story caretaker's, or gate tender's, house at Butt Valley. A barn was also moved near the new house from the area to be covered by the rising reservoir. Ben Goon, a long-time GWP employee, and his family moved into the new house (CA-189-1, CA-189-2) (Kramar 1963:19; Quadrio 1996) (see HAER No. CA-189-A for information on the Gate Tender's Complex).

Great Western Power Dam Construction -- 1924

Caribou began operation on May 6, 1921, producing electricity for Oakland and the San Francisco Bay region. This production made GWP serious competition for PG&E's market in northern California. Within a few years, dry seasons forced water to be directed through the Almanor Dam to the Big Bend Powerhouse, instead of through Butt Dam to Caribou. Caribou had a greater head than Big Bend, but less generating capacity. GWP decided to install a third generator in Caribou to prevent that energy loss in the future. Additional work was also needed near the intake of the Prattville tunnel. Channeling in Lake Almanor was necessary to increase head pressure at Caribou 1. Construction camps were set up for the workers needed to build the massive bulkheads and a channel 14,200 feet long (Shoup and Cornford 1987:22).

This construction project, under the direction of C. M. Mardel, Chief Engineer for GWP, and consulting engineer James D. Galloway, included improving the Butt Valley Dam and reservoir to ensure a continued supply of water to Caribou, work that was completed in early 1924 (Geomatrix 1995:3). The dam designer was Julius Howells and the contractor hired for the project was Niels Schultz, owner of Schultz Construction Company of San Francisco. For $13,193.16, Schultz agreed to build an hydraulic fill dam with a crest width of 20 feet at 4,144 feet amsl. The spillway elevation was set at 4,132 feet amsl. The dam's upstream slope was 3:1 and downstream slope was 2:1 (GWP 1923b; Mardel 1933:3).

The contractor was given use of GWP property during the construction period. This included the GWP camp at Butt Valley and timber from the old Butt Valley Powerhouse flume, as well as use of the company's branch railroad. This camp was also known as the maintenance camp and included cottages on a plateau downstream of the dam near the spillway. The caretaker's cottage and a number of barns and outbuildings were located just to the west (Mardel 1933:8).

The GWP prepared the dam site by grading one to one-and-a-half feet of soil in the puddle core area and removing all loose gravel and sand in the stream bed. During this work, a four-inch-diameter vent pipe to the 1902 tunnel was discovered in the puddle core area on the west side of the dam. It was removed in 1925 when Tunnel No. 2 developed problems (Mardel 1933:3-4, 6).

Schultz began work in June 1923. Construction consisted of conventional hydraulic sluicing fill grounded with upstream and downstream rock toes. The upstream toe began at the base of the previous rock fill dam built by Stone and Webster in 1921 (Geomatrix 1995:3; Mardel 1933:2, 4) and was ten feet wide at the crest with an upstream slope of 1-1/4:1. The downstream toe had a slope of 1-1/2:1 with a crest width of 20 feet. A road was graded on the top of the downstream rock toe.

Howells placed six Goldbeck cells in the middle of the dam's puddle core at elevation 4,103 feet amsl to determine how well it was solidifying. Goldbeck cells are a cell with a diaphragm that makes an electrical contact when subjected to internal air pressure. The cells were made on site using plans published in the *Proceedings of the Society of Civil Engineers*. However, the cells were installed without proper drainage for condensation and provided unreliable records (Mardel 1933:7).

The puddle core was made of fines predominately deposited under still water. The outer sections of the dam were called the stability sections and were made primarily of grit deposited under flowing water (see attached typical section of the 1923 Butt Valley Dam) (GWP 1923a). The new dam was faced on its water side with an 18-inch-thick layer of loose rock, known as rip-rap. The reservoir capacity was increased to 50,000 acre feet. This reserve of water was enough to run the Caribou system for 45 days without additional recharge from Lake Almanor. The spillway for this dam was built on the east abutment 12 feet below the dam's crest elevation of 4,144 feet amsl. (Coleman 1952:274; Galloway 1930; Shoup and Cornford 1987:15, 20-22).

When the dam showed signs of seepage, engineers installed four hydraulic fill silt blankets on the upstream toe of the dam in 1927. Silt blanket No. 4 extended from the crest of the old rock dam to the upstream slope of the hydraulic fill dam. Continuing concerns over seepage resulted in installation of a drain in 1935 along the east abutment below the dam (Geomatrix 1995:3). During December of 1938, workers installed a cedar log boom at the dam to stop driftwood from entering the intake tower (Siler 1996). In 1941, a bridge was built across the spillway of the dam (see attached site plan and typical section of the Butt Valley Dam and Spillway). Other than these changes, no significant structural changes have been made to the Butt Valley Dam (Jansen and Leps 1984:3).

IV. SOURCES

A. Engineering Drawings

Anonymous
1933 Plan of Butt Valley Dam and associated structures and complexes. On file, PG&E, San Francisco, California.

Great Western Power Company (GWP)
1923a *Topographic Map of Butt Valley Dam Site with Proposed Dam and Spillway* (includes a typical cross-section of the dam. It appears that a person by the name of Robarts drew the map. The map is dated June 1923. On file, Pacific Gas and Electric Company, San Francisco.

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B. Historic Maps and Views

Stone and Webster
1919 Caribou Development, Great Western Power Co., Stone and Webster, Boston (map). In *Stone & Webster Journal*, dated October 1919. On file, Meriam Library, California State University, Chico.

C. Interviews

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Siler, Harry
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1949 *Water Right Values - Pit River.* On file, Water Resources Collections Archives, University of California, Berkeley.

Peterson, O. W.
1938 Correspondence with J. H. Fagg, Pacific Gas and Electric Company, September 7, 1938. On file, Pacific Gas and Electric Company Archives, San Bruno. Box 11754, File: De Sabla Division, Butt Valley Dam to 1940.

The Plumas County Historical Society
1981 "He Was A Good Guy: The Story of Ben Goon." In *Plumas Memories*, Plumas County Historical Society Publication No. 11, April 7, 1963, No.11 and 17, May 1981 reprint. On file, Plumas County Museum, Quincy, California.

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1963 "Activity Along Butt Crick" In *Plumas County Historical Society Publication No. 11*, April 7, 1963. On file Special Collections, Meriam Library, CSU Chico.

Shoup, Laurence H. and Daniel Cornford
1987 *The Caribou 1 Powerhouse: An Historic Overview and National Register of Historic Places Evaluation.* Prepared for Pacific Gas and Electric Company, San Francisco.

Western Power Company
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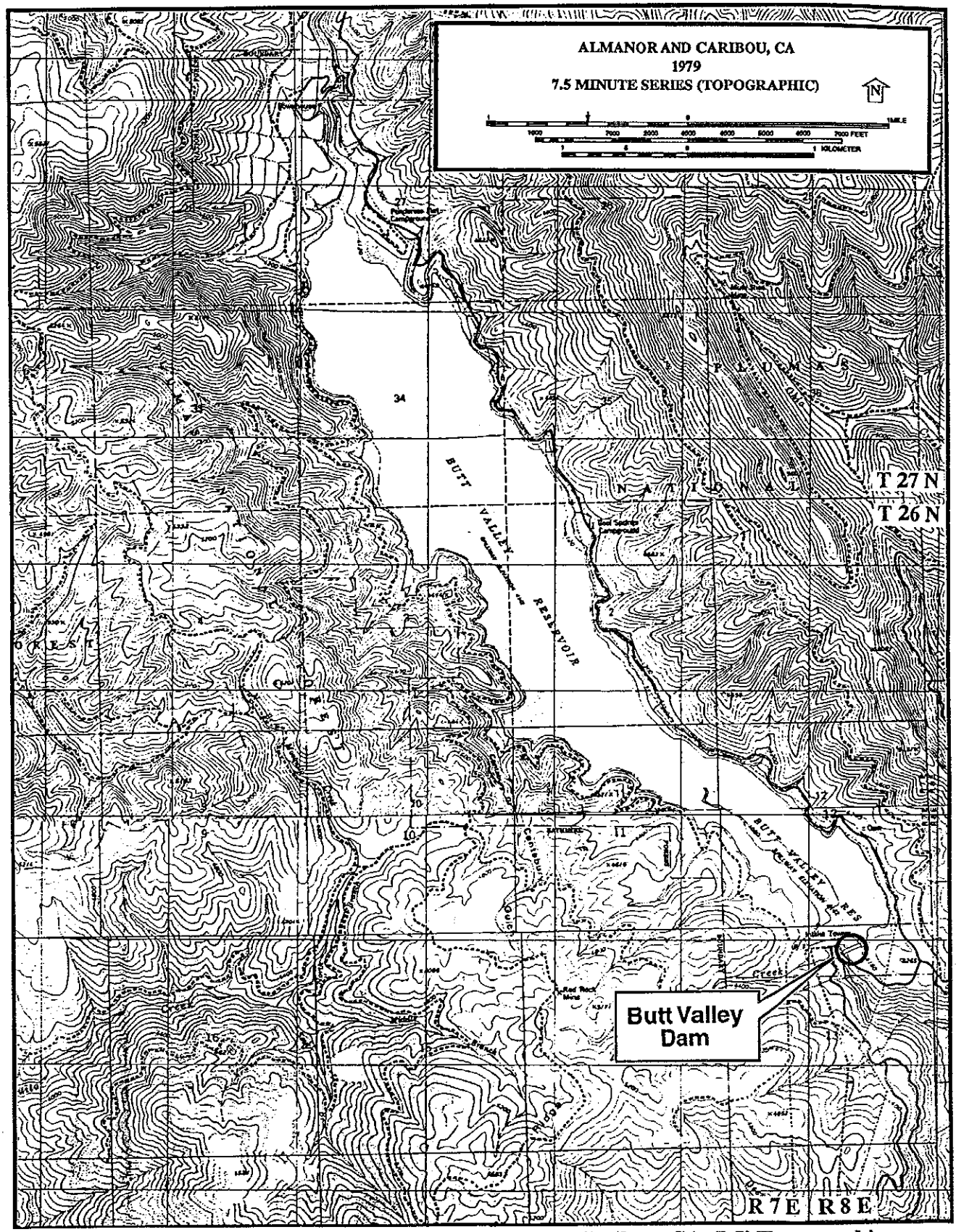
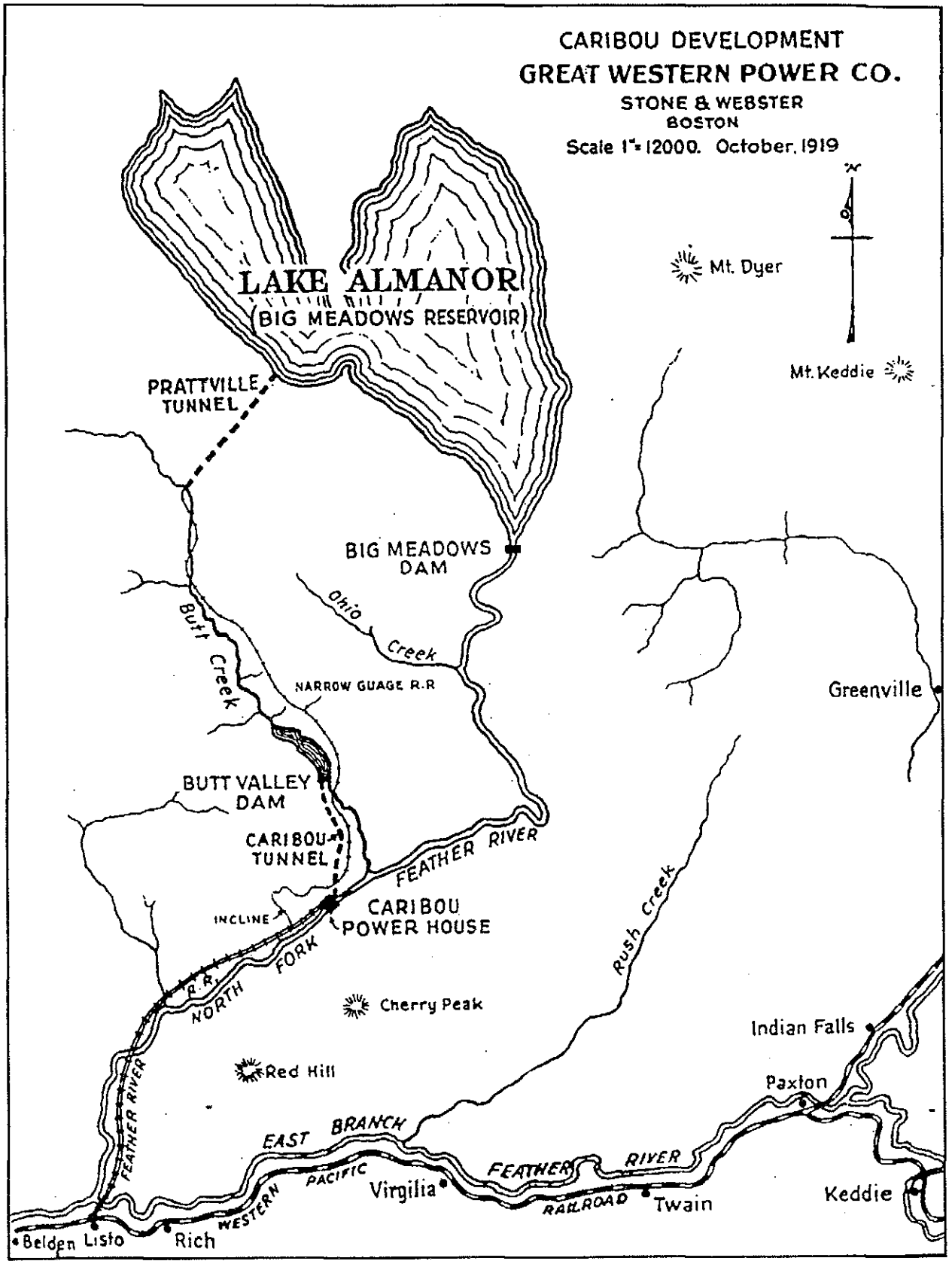
PART V. PROJECT INFORMATION

PG&E is currently seismically retrofitting the Butt Valley Dam. PG&E is recording the dam according to the HABS/HAER standards, and is filing documents with the State of California Office of Historical Preservation and the Western Regional Office of the National Park Service, San Francisco, California. This recordation has been prepared to meet those stipulations.

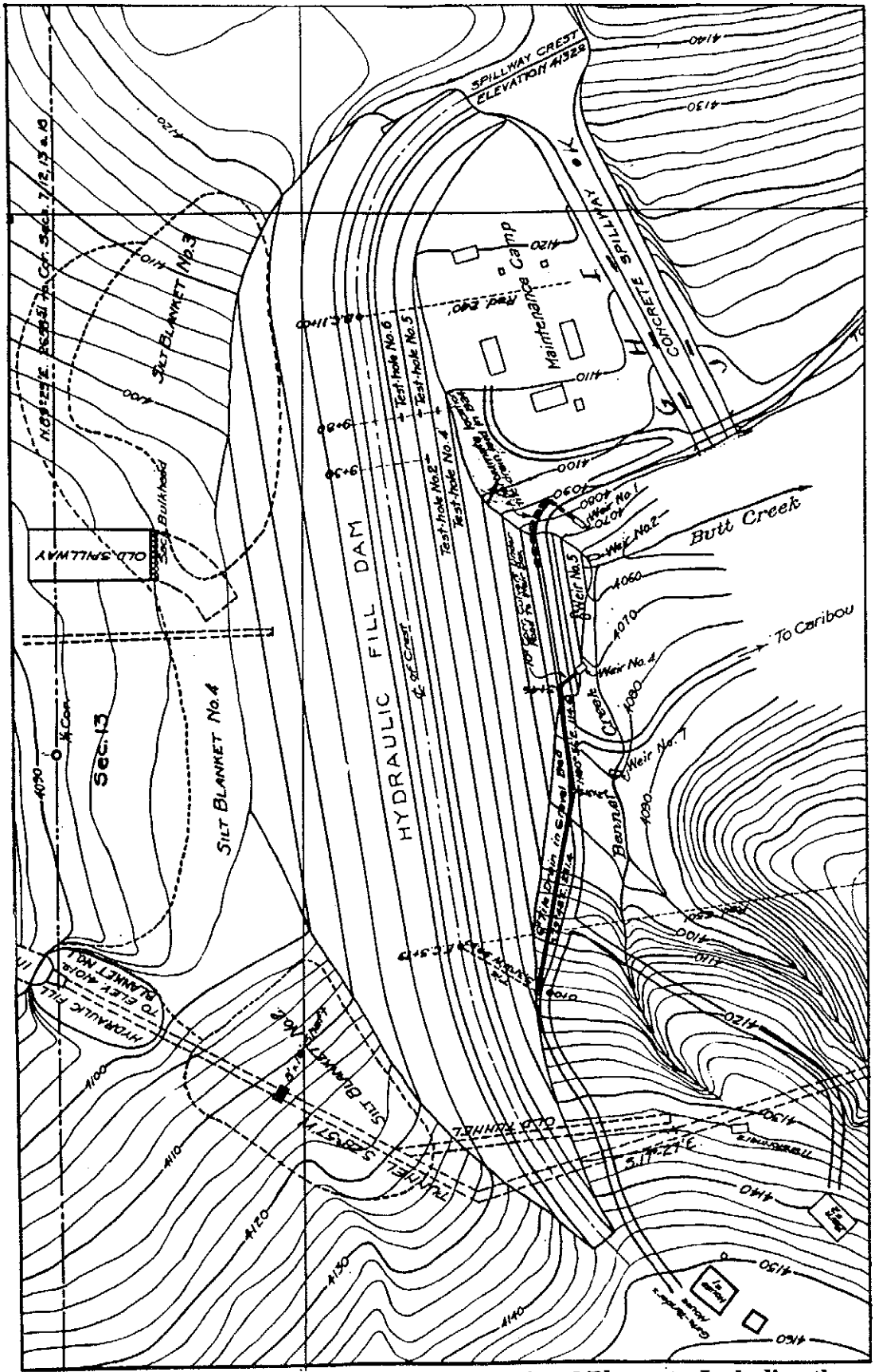
This report was compiled by Tracy D. Bakic with historical text prepared by Cindy L. Baker, Historian and engineering descriptions prepared by Mary L. Maniery, Historian. Maps and graphics were prepared by Claire Warshaw. The preceding are all employees of PAR Environmental Services Inc., Sacramento. Photography was prepared by David DeVries, Mesa Technical, Berkeley, California. The documentation is based on a previous investigation conducted by PAR Environmental Services entitled *National Register of Historic Places Evaluation of Butt Valley Dam, North Fork Feather River Hydroelectric System, Plumas County, California* (1996).



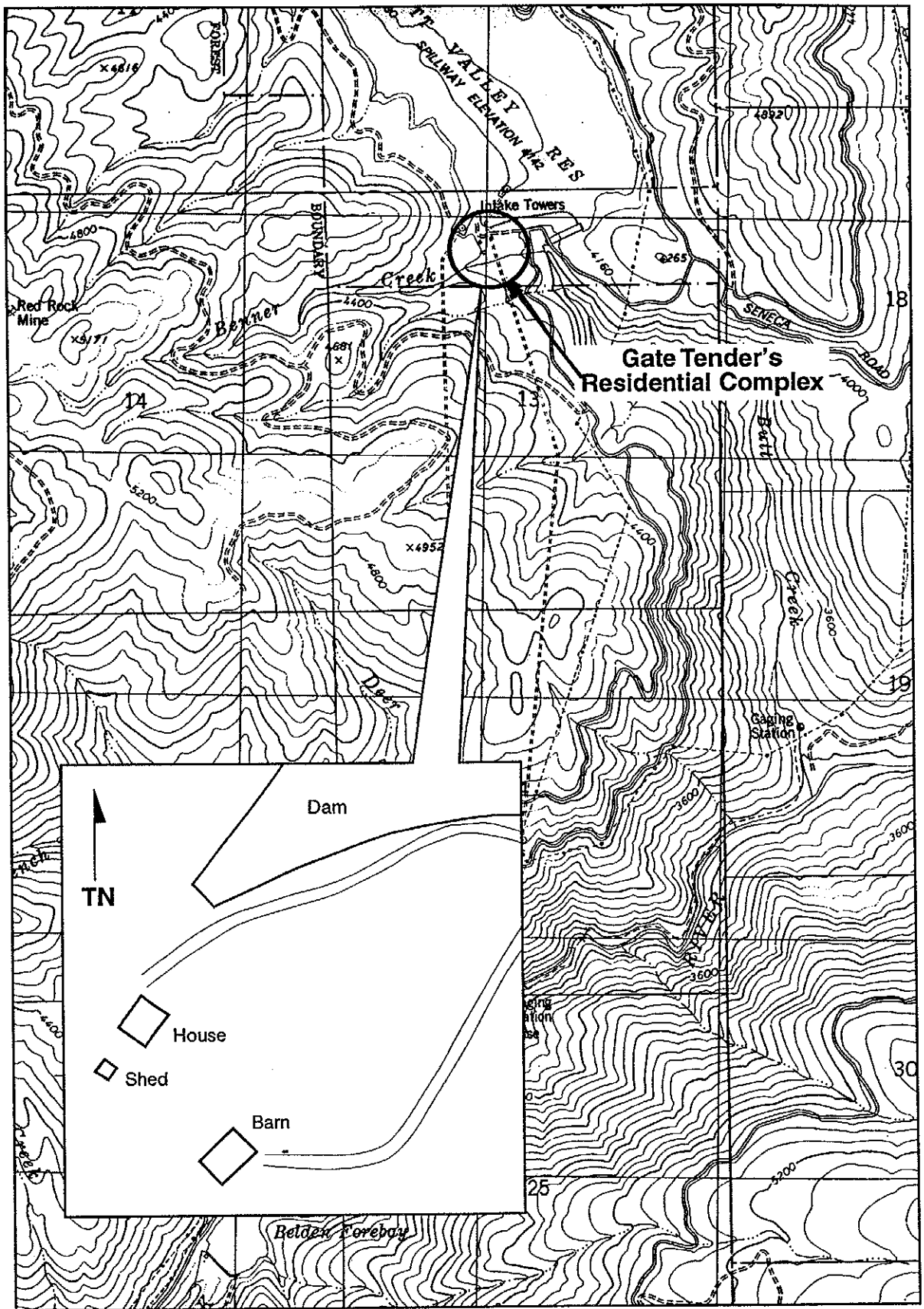
Location Map of Butt Valley Dam (USGS: Almanor and Caribou, CA, 7.5' Topographic Quadrangle 1979)



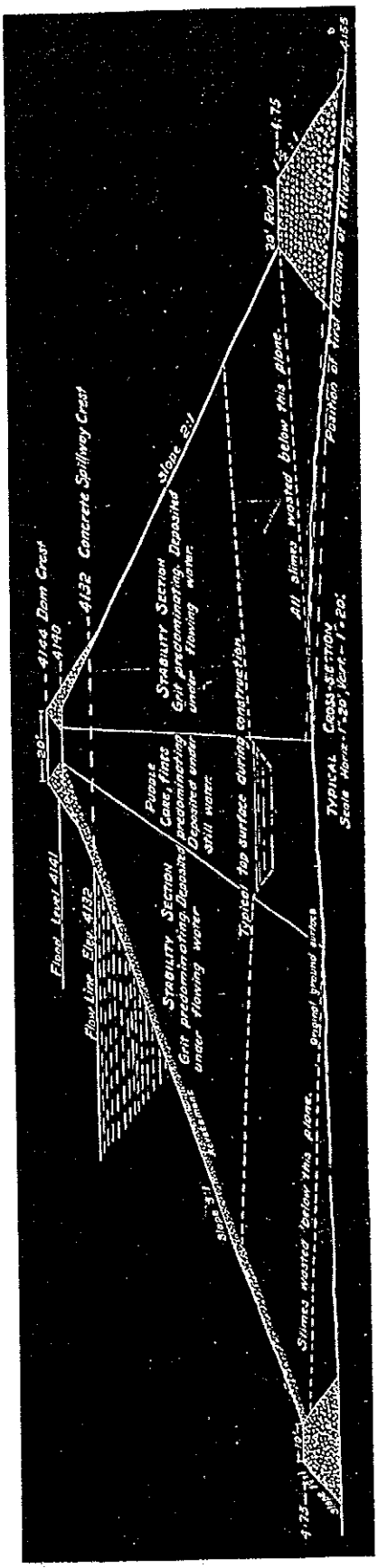
Map Depicting Caribou Powerhouse Development (Stone & Webster 1919)



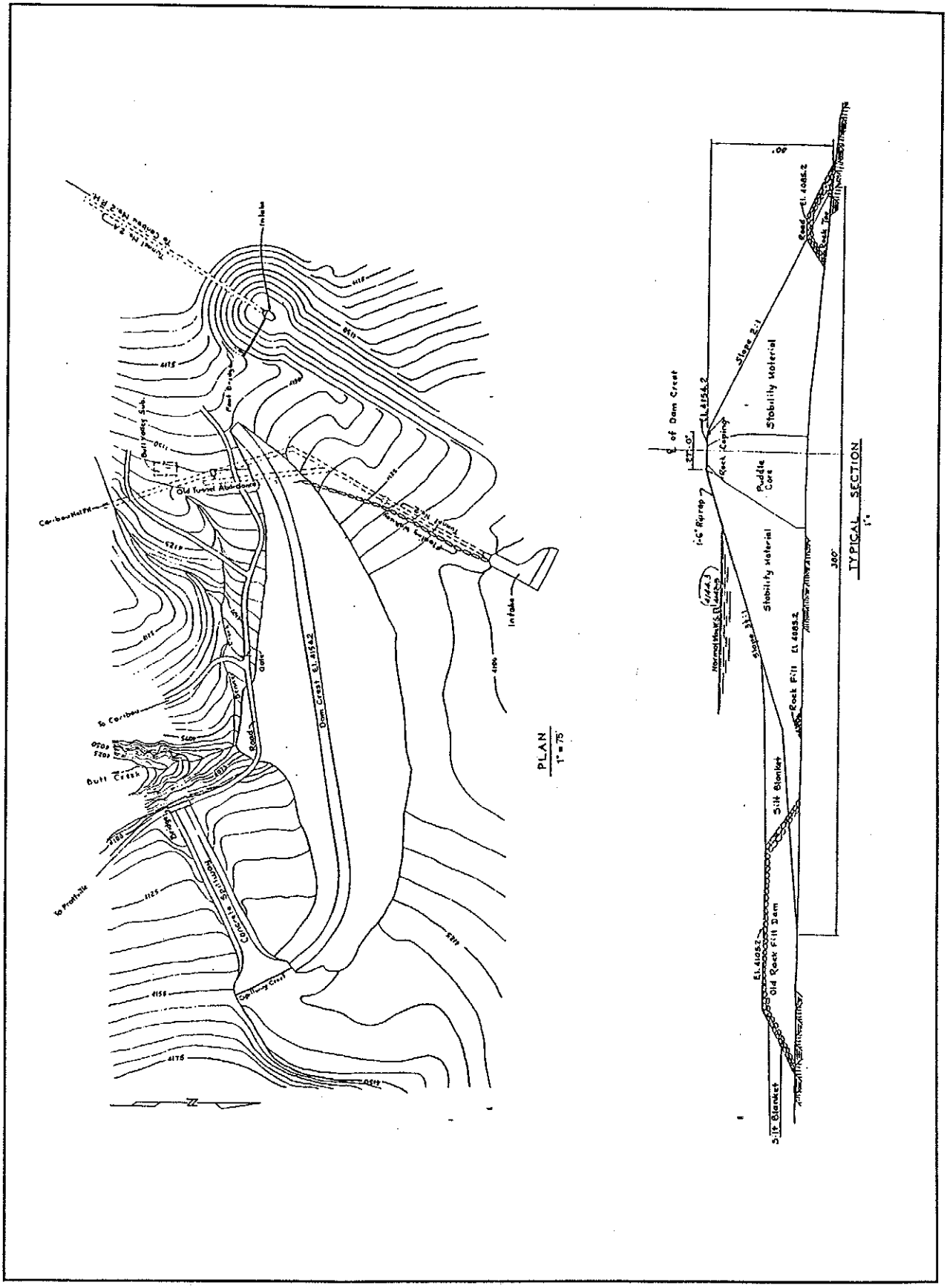
Map Depicting the Butt Valley Dam and Associated Elements, Including the Gate Tender's House, Shed and Barn (Anonymous 1933)



Location Map and Site Plan (Inset) of Butt Valley Dam Gate Tender's Residential Complex (USGS: Caribou, CA, 7.5' Topographic Quadrangle 1979)



Typical Section of the 1924 Butt Valley Dam (GWP 1923a)



Site Plan and Typical Section of the Butt Valley Dam and Spillway (PG&E 1971)